

### **REMARKS**

The present application had claims 23-25, 27-29, 31, 32, 34-37, 41-43, 45, 46 and 47 pending. Applicants have herein amended claims 23 and has canceled claim 47. Accordingly, claims 23-25, 27-29, 31, 32, 34-37, 41-43, 45 and 46 are now pending.<sup>1</sup>

Independent claim 23 has been amended to add the limitation from claim 47 – that is, the requirement that the sealing material comprises a thermoplastic polymer and is reinforced by an electrically insulating inorganic material which is incorporated into the sealing material as a filler during compounding in the range from 10 to 30 weight %. Claim 47 has cancelled. The amendment to claim 23 does not introduce new matter to the present disclosure.

In the May 20, 2011 Office Action, the Examiner rejected the pending claims under 35 USC §103(a) as allegedly being unpatentable over Nanaumi, *et al.* (US Patent Publication No. 2003/0049518) in view of Elmore, *et al.* (U.S. Patent No. 4,786,568) and in further view of Yandrasits, *et al.* (U.S. Patent Publication No. 2005/0263246), with some of the claims rejected in even further view of Komura, *et al.* (U.S. Patent Publication No. 2004/0142228) and Biegert (U.S. Patent Publication No. 2003/0049367). Applicants respectfully disagree with the Examiner's positions.

The Examiner repeatedly admits that the Nanaumi reference fails to teach many of the limitations present in independent claim 23 – including the limitation that the edges of the gas diffusion layers and the surface of the ion-conducting membrane that is not supported by the gas diffusion layer on the front side are enclosed by a sealing material which comprises a thermoplastic polymer and is reinforced by an electrically insulating

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<sup>1</sup> In the May 20, 2011 Office Action, the listing of claims appears to be incorrect, and inconsistent in the pages of the Office Action itself. For instance, page 1 of the Office Action indicates that claims 23-29, 31, 34-37, 41-43 and 45-47 are pending (erroneously includes claim 26 but is missing claim 32), while page 2 indicates that claims 23-25, 27-29, 31, 34-37, 41-43, 45-47 now stand rejected (doesn't include 26, but still missing 32). Pages 3, 8, and 9 of the Office Action have a different listing of claims - claims 23-31, 32, 33-34, 35-37, 38-45, 46, 47 (erroneously includes 26, 30, 33, 38-40, and 44).

inorganic material. See for instance, the May 20, 2011 Office Action, the first full paragraph on page 5.

To overcome these shortcomings of Nanaumi, the Examiner cites to four (4) additional references: Elmore, Yandrasits, Komura, and Biegert. As discussed below these additional references are either improper prior art to the present application or are directed to non-analogous technologies, and in addition, are distinguishable from the presently claimed invention.

The Elmore reference is directed to phosphoric acid fuel cells having a liquid, aqueous electrolyte (see col. 2, lines 46-48). This technology is separate and distinct from that of the present invention and is not applicable to PEM fuel cells having a solid polymer electrolyte. One of ordinary skill in the art of PEM fuel cells would not look to phosphoric acid fuel cells having a liquid, aqueous electrolyte to solve the shortcomings of Nanaumi which has a solid polymer electrolyte membrane (see "Field of the Invention" of Nanaumi).

Furthermore, Elmore uses inks with carbon black or graphite filler and a fluorocarbon binder. These inks contain about 50-75% solids and are soaked into the carbon electrode substrate (see col. 5, lines 54-61). Carbon black and graphite are not an "electrically insulating material" as required by the elements of independent claim 23. Further, the fillers of Elmore are not added by compounding a thermoplastic polymer – as required by claim 23. And also, the fillers are added in a range outside the range set forth in claim 23.

Lastly, Elmore fails to teach the use of an electrically insulating inorganic material which comprises glass fibers or glass spheres as set forth in dependent claim 46. The term "inorganic solids compatible with phosphoric acid at temperatures of 400°F" is too vague and does not lead a skilled person in the field of solid polymer electrolyte membrane technology to the use of glass fibers or glass spheres in an electrically insulating inorganic material.

The Yandrasits reference does not supply the missing teachings that are lacking in Nanaumi and Elmore. The reference is completely silent as to the use of compounded sealing materials.

The Komura reference is not prior art to the present application. Komura was filed December 23, 2003 – more than five (5) months after the priority date of the present application (July 14, 2003).

In any event, the Komura reference teaches the use of resins reinforced with glass fibers for the making of terminal plates (i.e., bipolar plates) of the fuel cell stack (see sections 98 and 0103). Komura teachings are applicable for terminal plates on the stack level, not layers on the membrane electrode assembly level. Furthermore, the reinforced resins of Komura are not being used for the sealing and impregnation of the gas diffusion layers of the MEA, as required by the claims of the present application.

One of the objectives of the present invention is to provide a better MEA design compared to state of the art MEAs. This improved design is characterized by

- a) removing the danger of short-circuiting
- b) gas-tight sealing thereby preventing hydrogen penetration and
- c) high creep resistance under mechanical strength.

The use of the semi-coextensive design and thermoplastic polymers reinforced with inorganic materials in the present percentage as sealants, a very creep resistant, stable polymer rim is obtained.

The cited references, either alone or in combination, do not disclose, teach or suggest the claimed MEAs of the present invention, or the sealing of the edges of the gas diffusion layers and/or the membrane with a thermoplastic polymer that is reinforced by an electrically insulating inorganic material wherein the material is incorporated into the

sealing material as a filler during compounding in the range from 10 to 30 weight %.


Nowhere in Nanaumi or the secondary references is it taught to reinforce a thermoplastic polymer sealing material with electrically insulating, inorganic fillers during compounding in the range from 10 to 30 weight %. In light of this deficiency of the references (among others), Applicants maintain that the claimed invention, as presently set forth in the amended claims above, is patentably distinct from the cited references, either alone or in combination.

In light of the foregoing remarks and claim amendments, Applicants respectfully request withdrawal of the rejections set forth in the May 20, 2011 Office Action and solicit allowance of the present application.

No fee is believed due in connection with the filing of the present amendment, other than the fee for the requested two-month extension of time. If any additional fees are due, please charge our Deposit Account No. 50-5371 for such sum.

If the Examiner has any questions regarding the present application, the Examiner is cordially invited to contact Applicants' attorney at the number provided below.

Respectfully submitted,

A handwritten signature in black ink, reading "John J. Santalone", written over a horizontal line.

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